

Stat 564 review of topics for midterm

Simple linear regression: estimates of intercept, slope, and error variance, as well as standard errors of the slope and intercept estimates

Hypothesis tests, confidence intervals, and prediction intervals

Interpretation of R^2 and R^2_{adj}

ANOVA table for regression

Hypothesis test for linear combinations of the parameters

Bonferroni and Scheffé joint confidence intervals

Residual and multicollinearity diagnostics

Your midterm take-home exam will be emailed to your PSU address on the morning of Tuesday, Nov 7.

Practice problems

Stat 4/564

Fall 2017

November 2

1. Assume the model $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, $i = 1, \dots, n$, where $\beta_1 = \beta_0$.

- Find the least-squares estimator.
- Find the standard error of the estimator.

2. Suppose that you have fit the model

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \epsilon_i, \quad i = 1, \dots, 20,$$

and you want to test the following set of restrictions:

$$\beta_1 = 0$$

$$\beta_2 = 2.$$

- Write the matrix A that would allow these restrictions to be written in the form $A\beta = \vec{0}$.
- What would the numerator and denominator degrees of freedom be for the additional sum of squares F test?

3. Find the regression model for predicting \mathbf{Y} (weight) based on \mathbf{X}_1 (age), \mathbf{X}_2 (height), and \mathbf{X}_3 (indicator for male). Consider as predictors all possible linear and quadratic terms. Include all appropriate diagnostics. Predict a new \mathbf{Y} when $\mathbf{X}_1 = 26$, $\mathbf{X}_2 = 70$, and $\mathbf{X}_3 = 1$, giving a 95% prediction interval.

Y	X1	X2	X3
240.00	20	71.0	1
100.43	20	67.2	0
233.41	20	68.1	1
107.61	20	67.7	0
238.91	20	68.6	1
97.03	21	65.2	0
233.66	21	67.6	0
107.79	21	67.4	0
109.71	21	67.5	0
168.00	21	69.4	1
86.90	22	65.1	0
101.19	22	66.2	0
323.27	22	71.6	1
111.44	22	67.4	0
220.00	22	69.2	1

Y	X1	X2	X3
105.92	23	66.2	0
115.98	23	67.3	0
122.05	23	67.6	0
280.65	23	69.0	1
102.74	23	66.0	0
97.46	24	65.4	0
127.92	24	67.8	0
288.27	24	68.4	1
230.00	24	70.8	1
91.06	24	64.7	0
321.51	25	69.0	1
95.76	25	63.8	0
293.46	25	67.9	1
103.51	25	65.2	0
280.00	25	72.0	1